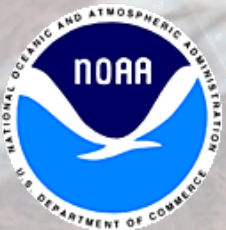


LAPS WORKSHOP SUMMARY



Oct. 25-27 2010, ESRL, Boulder, CO

LAPS' ROLE IN NWP

Map Satellite Terrain

- **Unique** combination of **features**
 - Quality - Consistency of analysis with observations
 - Fine resolution to resolve severe weather phenomena (1 km or less)
 - Very rapid update (15 mins or less)
 - Convection initiation (“hot start”) for forecasts
 - High portability
 - Ease of use
- Primary **application areas**
 - Situational awareness – Nowcasting, verification
 - Convective initiation, aviation, winter weather
 - Warn-On-Forecasting
 - Severe, fire, tropical, hydromet weather forecasting
- **User base** - 150+ users worldwide
 - NWS – WFOs via **AWIPS2**
 - Critical for WFO control of analysis (including QC) & work flow
 - Other US agencies – DHS, FAA, DoD, NASA
 - Private sector – Renewable Energy, weather forecasting
 - Internationally – Weather forecast agencies in Europe and Asia

OVERALL RECOMMENDATIONS

- **Continue development and support of LAPS**
 - To serve enterprise needs for fine scale
 - Analysis - Nowcasting
 - Model initialization – Hot start NWP forecasting
- **Maintain & further enhance unique features of LAPS**
 - Quality, fine resolution, convection initialization, very rapid updates, high portability, ease of use

SPECIFIC RECOMMENDATIONS

- **Data sources**
 - Add new static, observational, & background data
- **Software**
 - LAPS-WRF Portal (GUI); Parallelization
- **Scientific developments** – Transition to STMAS
 - 3/4DVAR; Ensemble-based covariances; WOF;
Consistency between DA & forecasting (cycled DA)
- **Outreach**
 - DTC support for LAPS; Test LAPS in HWT; User training; Use community standards & improvements;
Transition variational “hotstart” etc to NCEP operations
- **Follow-up**
 - Annual / biannual LAPS workshops
 - BAMS workshop summary & special LAPS journal issue

DETAILED DISCUSSION

- Workshop logistics
- User requirements
- Data needs
- Software requirements
- Scientific opportunities
- Collaboration

WORKSHOP LOGISTICS

- **Organized by Forecast Applications Branch** of GSD
 - <http://esrl.noaa.gov/gsd/fab/workshops/>
- **Held 25-27 Oct 2010** at GSD/ESRL/OAR/NOAA in Boulder
- **35 participants**, including 6 via telecon
 - OAR – GSD, NSSL
 - NWS – Southern & Central Regions, Training Center
 - NESDIS
 - Academia – NCAR, CIRA
 - International – Finland, Spain, China
 - Private Sector – Vaisala, WDT, Precision Winds, Radiometrics
- **30 presentations**, including 5 posters
- 2 sessions of **Working Group discussions** on recommendations

USER REQUIREMENTS

- **Quality** of analyses & forecasts
 - Number of problems highlighted
 - Noise in analysis, spin-up in forecast, need for better QC, etc
 - Must set priorities
 - Some solutions offered by partners
- **Portability**
 - AWIPS2 & other platforms
- **Efficiency**
 - Must run in timely manner
- **Ease of use**
 - Must remain easy to set up
 - User interface must remain simple

DATA NEEDS

- **Data exchange**
 - Use new community standards & web services for
 - Accessing input data – Via NNEW
 - Sharing output data - Incorporate into 4-D Data Cube
- **“Static” data**
 - Fine resolution terrain, land surface, etc info
 - E.g., Topograbber
- **Observational data** – Include new types
 - Dual polarization etc radar, TDWR, lidar, satellite, etc
- **Background forecast**
 - Test new approaches
 - Cycled forecasts from LAPS analysis
 - ECMWF 16 km global forecast

SOFTWARE REQUIREMENTS

- **LAPS / WRF Portal**
 - Develop user friendly GUI for
 - Set-up, data access, QC, running & monitoring LAPS & ensuing WRF forecast
 - Many elements exist
 - WRF Portal, LAPS domain wizard, NNEW, etc
 - Great potential benefits – Incident meteorology
 - Assimilate fire weather related observations in field
- **Efficiency**
 - Emphasis on parallelization; Explore use of GPU
- Conform with **coding etc standards**
 - How to interface with GIS
- **Documentation**
- **Protocol for external contributions** to LAPS
 - Korea, Finland, Spain, Taiwan, Chine, private sector

SCIENCE OPPORTUNITIES

- **3/4Dvar development** – Beta testing of Space-Time Multiscale Analysis System (STMAS)
 - Better use of observational data – Eg, observation time used
 - Cross-variable background error covariances
 - Physical balances consistent with observations – Eg, precipitation
- **Estimation of uncertainty** in
 - Observations
 - QC improvements, observational & representativeness errors
 - Analyses and forecasts
 - Ensemble coupled with 3/4Dvar – Hybrid DA (ensemble-based covar.)
- Choice of **background** field
 - Forecast from previous LAPS analysis - **cycled DA**
 - Desired but problems with errors on fine scales due to
 - Chaotic error growth and boundary effects
 - Role of dynamical downscaling
- **Initialization** of NWP forecasts
 - Analysis must be consistent with NWP models used
 - Eg, vertical coordinate, microphysics, land surface model

LAPS & THE COMMUNITY

- Recommend **DTC** supports LAPS
 - Option for WRF initialization
 - Analysis and forecast evaluation / verification
- Recommend **HWT** test use of LAPS for
 - Situational awareness / nowcasting
 - Warn-On-Forecasting
- **Training**
 - NWS developing training package for
 - Set-up, running of LAPS
 - Need mandate / funding for package *on use of LAPS*
 - Products, examples, good practices, etc
- **Consistency of LAPS with other NWP systems**
 - Use community supported tools/formats (bufr, geogen, GIS)
 - Integrate community improvements into LAPS
 - Transfer successful LAPS methods into NCEP operer. (GSI)

FOLLOW-UP

- Need regular **LAPS User Workshops**
 - Annual or bi-annual frequency depending on need
- **Publicize** outcome of workshop & LAPS
 - Write BAMS meeting summary by winter 2010/11
 - Submit collection of LAPS papers by spring 2011
 - Organize special journal issue
 - Potentially 10+ papers
 - LAPS overview
 - NWS survey
 - Description how LAPS used at WFOs
 - Contributed papers by other users
 - Contributed papers on new LAPS developments